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Toshiyuki Takizawa

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EXAMINER

QUINTO, KEVIN V

ART UNIT

PAPER NUMBER

2826

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PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	Application No. 10/790,864	Applicant(s) TAKIZAWA, TOSHIYUKI	
	Examiner Kevin Quinto	Art Unit 2826	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

#### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) ☒ Responsive to communication(s) filed on 29 June 2007.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) ☒ Claim(s) 1-76 is/are pending in the application.
- 4a) Of the above claim(s) 19-21 and 38-76 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-8, 18, 23-27, 29-31 and 37 is/are rejected.
- 7) ☒ Claim(s) 9-17, 22, 28 and 32-36 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 03 March 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All    b) ☐ Some \*    c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)  | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)   | 5) <input type="checkbox"/> Notice of Informal Patent Application                       |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)<br>Paper No(s)/Mail Date <u>21 May 2004</u> . | 6) <input type="checkbox"/> Other: _____  |

## **DETAILED ACTION**

### ***Election/Restrictions***

1. Claims 38-76 withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected species, there being no allowable generic or linking claim. Election was made **without** traverse in the reply filed on June 29, 2007.
2. The applicant states that claims 19-21 read on figure 1. However the examiner respectfully disagrees. Claim 19 contains the limitation, "wherein a part including the acceptor element and a part including the localized band formation element are separated spatially." Figure 1 does not have a part with the acceptor element and a part with the localized band formation element which are separated spatially. Claim 20 contains the limitation, "wherein the part including the acceptor element and the part including the localized band formation element are different semiconductors." Figure 1 does not have different semiconductors. These two claim limitations are described with regard to figure 6 on p. 19, lines 25-32 and p. 20, lines 1-31 of the currently filed specification. Therefore claims 19-21 are withdrawn from further consideration by the examiner, 37 CFR 1.142(b), as being drawn to a non-elected species.

### ***Claim Objections***

3. Claims 3-18 are objected to because of the following informalities: claim 3 contains the phrases "wherein amount" and "larger than amount" which are grammatically incorrect. Appropriate correction is required.

4. Claim 18 is further objected to because of the following informalities: claim 18 contains the phrase "is higher than thermal energy at temperature when said semiconductor is used" which is grammatically incorrect. Appropriate correction is required.
5. Claim 22 is objected to because of the following informalities: claim 22 contains the phrase "has a crystal defect caused by missing of a Group III element" which is grammatically incorrect. Appropriate correction is required.
6. Claims 9, 12, 28, 31 are objected to because of the following informalities: each of these claims contains the phrase "at least one Group III elements" which is grammatically incorrect. Appropriate correction is required.
7. Claims 12 and 31 are objected to because of the following informalities: each of these claims contains the phrase "at least one Group V elements" which is grammatically incorrect. Appropriate correction is required.
8. Claims 14, 17, and 36 are objected to because of the following informalities: each of these claims contains the phrase "at least one Group VI elements" which is grammatically incorrect. Appropriate correction is required.
9. Claims 14, 17, 33, and 36 are objected to because of the following informalities: each of these claims contains the phrase "at least one Group II elements" which is grammatically incorrect. Appropriate correction is required.

***Claim Rejections - 35 USC § 102***

10. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

11. Claims 1-5, 7, 8, 18, 23, 24, 26, 27, 29, 30, 31, and 37 are rejected under 35 U.S.C. 102(b) as being anticipated by Shakuda (USPN 5,825,052).

12. In reference to claim 2, Shakuda (USPN 5,825,052) discloses a material which meets the claim. Figure 1 of Shakuda discloses a p-type semiconductor comprising a localized band formation element (phosphorus, arsenic) which is isovalent with at least one of elements which compose the semiconductor (nitrogen) and has smaller electronegativity than electronegativity of said element (column 4, lines 1-45, column 8, lines 66-67, column 9, lines 1-65).

13. With regard to claim 2, Shakuda discloses that the p-type semiconductor (column 4, lines 26-29, column 9, lines 66-67, column 10, lines 1-2) has an acceptor element (beryllium, magnesium, zinc, cadmium, calcium) which has fewer valence electrons than valence electrons of at least one of the elements (nitrogen) which compose the semiconductor.

14. In reference to claim 3, an amount of the localized band formation element is larger than an amount of the acceptor element.

15. With regard to claim 4, the acceptor element has a lower energy level than a top of an energy band for that of the localized band formation element.

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16. In reference to claim 5, the acceptor element and the localized band formation element are distributed uniformly.

17. In reference to claim 7, the p-type semiconductor is a compound semiconductor (gallium nitride).

18. With regard to claim 8, the p-type semiconductor is a nitride semiconductor (gallium nitride).

19. In reference to claim 18, the energy gap between an energy level which the acceptor element has and a top of an energy band which the localized band formation element has is higher than the thermal energy at the temperature when the semiconductor is used.

20. With regard to claim 23, there is an acceptor element (beryllium, magnesium, zinc, cadmium, calcium) which has fewer valence electrons than valence electrons of at least one of the elements (nitrogen) which compose the semiconductor. The acceptor element has a lower energy level than a top of an energy band for that of the localized band formation element.

21. In reference to claim 24, there is an acceptor element (beryllium, magnesium, zinc, cadmium, calcium) which has fewer valence electrons than valence electrons of at least one of the elements (nitrogen) which compose the semiconductor. The acceptor element and the localized band formation element are distributed uniformly.

22. In reference to claim 26, the p-type semiconductor is a compound semiconductor (gallium nitride).

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23. With regard to claim 27, the p-type semiconductor is a nitride semiconductor (gallium nitride).

24. With regard to claim 29, Shakuda discloses that the p-type semiconductor is a nitride semiconductor (gallium nitride) and has an acceptor (column 4, lines 26-29, column 9, lines 66-67, column 10, lines 1-2) element (beryllium, magnesium, zinc, cadmium, calcium) which has fewer valence electrons than valence electrons of at least one of the elements (nitrogen) which compose the semiconductor.

25. In reference to claim 30, Shakuda discloses that the p-type semiconductor is a nitride semiconductor (gallium nitride) and the localized band formation element is phosphorus or arsenic (column 4, lines 1-45, column 8, lines 66-67, column 9, lines 1-65).

26. In reference to claim 31, the p-type semiconductor is a nitride semiconductor which has at least one Group III element including boron (column 10, lines 10-14) and at least one Group V element including nitrogen.

27. In reference to claim 37, there is an acceptor element (beryllium, magnesium, zinc, cadmium, calcium) which has fewer valence electrons than valence electrons of at least one of the elements (nitrogen) which compose the semiconductor. The energy gap between an energy level which the acceptor element has and a top of an energy band which the localized band formation element has is higher than the thermal energy at the temperature when the semiconductor is used.

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***Claim Rejections - 35 USC § 103***

28. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

29. Claims 6 and 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shakuda (USPN 5,825,052).

30. In reference to claim 6, Shakuda does not teach the exact atom% for the localized band formation element as that claimed by the applicant. However::

"[W]here the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation." In re Aller, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955)

Therefore claim 6 is not patentably distinguishable over the Shakuda reference.

31. In reference to claim 25, Shakuda does not teach the exact atom% for the localized band formation element as that claimed by the applicant. However::

"[W]here the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation." In re Aller, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955)

32. Therefore claim 25 is not patentably distinguishable over the Shakuda reference.

***Allowable Subject Matter***

33. Claims 32-35 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.



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34. The following is a statement of reasons for the indication of allowable subject matter: the examiner is unaware of any prior art which suggests a p-type oxide semiconductor containing a localized band formation element which has a smaller electronegativity as one of the elements of the semiconductor.

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***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kevin Quinto whose telephone number is (571) 272-1920. The examiner can normally be reached on M-F 8AM-5PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Sue Purvis can be reached on (571) 272-1236. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

KVQ

  
**EVAN PERT**  
**PRIMARY EXAMINER**